CLAIMS

1. A substrate cutting system, comprising:

a pair of scribing line forming means arranged facing each other;

a pair of scribing devices for supporting the pair of scribing forming line means such that one of the pair of scribing forming line means moves on a first surface of a substrate in an X axial direction and the other of the pair of scribing forming means moves on a second surface of the substrate in the X axial direction;

a scribing device guide body for supporting the pair of scribing devices such that the pair of scribing devices moves in a Y axial direction; and

a substrate supporting means for supporting the substrate in an X-Y plane such that the pair of scribing forming line means scribes the first surface of the substrate and the second surface of the substrate.

2. A substrate cutting system according to claim 1, wherein the substrate supporting means includes:

a substrate supporting device being supporting by the scribing device guide body and moving together with the pair of scribing devices in the Y axial direction; and

a fixing device for fixing the substrate in the X-Y plane.

3. A substrate cutting system according to claim 2, wherein the substrate supporting device supports the substrate such that the substrate supporting device does not rub the substrate or exert any force on the substrate when the pair of scribing devices and the scribing device guide body move in the Y axial direction.

4. A substrate cutting system according to claim 2, wherein the substrate supporting device includes:

a first substrate supporting section being provided on one side of the substrate supporting device with respect to a moving direction of the scribing device guide body.

5. A substrate cutting system according to claim 4, wherein the first substrate supporting section includes a plurality of first substrate supporting units, the plurality of first substrate supporting units moving in parallel along the moving direction of the scribing device guide body, and

the plurality of first substrate supporting units moves together with the scribing device guide body along with the movement of the scribing device guide body.

6. A substrate cutting system according to claim 5, wherein the first substrate supporting unit includes a substrate supporting means for supporting the substrate.

7. A substrate cutting system according to claim 6, wherein the substrate supporting section is a plurality of cylindrical rollers.

8. A substrate cutting system according to claim 7, comprising at least one rotation transmission means for rotating the plurality of cylindrical rollers in accordance with the movement of the scribing device guide body.

9. A substrate cutting system according to claim 7, comprising a control section for rotating the plurality of cylindrical rollers in accordance with the movement of the scribing device guide body.

10. A substrate cutting system according to claim 6, wherein the substrate supporting means is a plurality of belts.

11. A substrate cutting system according to claim 10, comprising at least one rotation transmission means for circling the plurality of belts in accordance with the movement of the scribing device guide body.

12. A substrate cutting system according to claim 10, comprising a control section for circling the plurality of belts using a motor in accordance with the movement of the scribing device guide body.

13. A substrate cutting system according to claim 2, wherein the substrate supporting device includes:

a second substrate supporting section being provided on another side of the substrate supporting device with respect to a moving direction of the scribing device guide body.

14. A substrate cutting system according to claim 13, wherein the second substrate supporting section includes a plurality of second substrate supporting units, the plurality of second substrate supporting units moving in parallel along the moving direction of the scribing device guide body.

15. A substrate cutting system according to claim 14, wherein the second substrate supporting unit includes a substrate supporting means for supporting the substrate.

16. A substrate cutting system according to claim 15, wherein the substrate supporting section is a plurality of cylindrical rollers.

17. A substrate cutting system according to claim 16, comprising at least one rotation transmission means for rotating the plurality of cylindrical rollers in accordance with the movement of the scribing device guide body.

18. A substrate cutting system according to claim 16, comprising a control section for rotating the plurality of cylindrical rollers in accordance with the movement of the scribing device guide body.

19. A substrate cutting system according to claim 15, wherein the substrate supporting means is a plurality of belts.

20. A substrate cutting system according to claim 19, comprising at least one rotation transmission means for circling the plurality of belts in accordance with the movement of the scribing device guide body.

21. A substrate cutting system according to claim 19, comprising a control section for circling the plurality of belts using a motor in accordance with the movement of the scribing device guide body.

22. A substrate cutting system according to claim 1, wherein the pair of scribing devices each includes a cutter head for transmitting a pressing force of the scribing forming means onto the substrate using a servo motor.

23. A substrate cutting system according to claim 1, comprising a steam unit section for spraying steam onto the first surface and the second surface of the substrate.

24. A substrate cutting system according to claim 23, wherein a substrate drying means is provided in the steam unit section, the substrate drying means being for drying the first surface and the second surface of the substrate.

25. A substrate cutting system according to claim 24, wherein the substrate drying means includes:

at least one air knife body having a slit section formed thereon, the slit section capable of discharging a pressurized gas;

an air knife supporting section for supporting the at least one air knife body such that a fluid lead-in path is formed between the at least one air knife body and a main surface of the substrate in a substrate transportation path, the at least one air knife body and the substrate move relative to each other in the substrate transportation path, the fluid lead-in path having approximately a uniform shape in a direction perpendicular to the relative moving direction; and

a wall face, arranged facing the at least one air knife body in the relative moving direction, for constituting a fluid lead-out path, the fluid lead-out path leading out the dry gas such that the dry gas, which has been discharged from the slit section and passed through the fluid lead-in path, moves away from the main surface of the substrate.

26. A substrate cutting system according to claim 25, wherein the wall face is arranged at a position facing the at least one air knife unit body such that a fluid-sectional area of the fluid lead-out path is larger than fluid-sectional area of the fluid lead-in path.

27. A substrate cutting system according to claim 25, wherein the air knife supporting section includes a clearance adjustment means for adjusting a clearance between the at least one air knife body and the main face of the substrate using the Venturi effect which occurs when the dry gas passes through the fluid lead-in path.

28. A substrate cutting system according to claim 27, wherein the clearance adjustment means includes:

an elastic member for supporting the at least one air knife body between the elastic member and the main surface of the substrate in an oscillating manner; and

a laminar flow forming face for passing the dry gas between the laminar flow forming face and the main surface of the substrate in a laminar flow state, the

laminar flow forming face being formed on one side surface of the at least one air knife body, the one side surface facing the main surface of the substrate and forming a portion of the fluid lead-in path.

29. A substrate cutting system according to claim 25, wherein each side of the at least one pair of air knife bodies on which the slit section is formed is arranged facing each other.

30. A substrate cutting system according to claim 26, wherein each side of the at least one air knife body on which the slit section is formed is arranged facing each other.

31. A substrate cutting system according to claim 23, comprising a substrate carry-out device for retrieving the substrate cut by the steam unit section.

32. A substrate cutting system according to claim 31, wherein the substrate carry-out device includes a carry-out robot,

the carry-out robot includes:

a substrate holding means for holding the substrate;

a substrate rotating means for rotating the substrate holding means, having the substrate supported thereby, around a first axis vertical to the substrate; and

a substrate circling means for circling the substrate rotating means around a second axis, the second axis being different from the first axis vertical to the substrate held by the substrate holding means.

33. A substrate cutting system according to claim 32, wherein the circling of the substrate holding means by the substrate circling means is transmitted to the substrate rotating means by a dynamic power transmission mechanism which results in the rotation of the substrate rotating means to rotate.

34. A substrate cutting system according to claim 33, wherein the rotating direction of the substrate holding means by the substrate rotating means is opposite to the circling direction of the substrate holding means by the substrate circling means.

35. A substrate cutting system according to claim 34, wherein the rotating angle of the substrate holding means by the substrate rotating means is twice the circling angle of the substrate holding means by the substrate circling means.

36. A substrate cutting system according to claim 32, wherein the rotating drive of the substrate holding means by the substrate rotating means and the circling drive of the substrate holding means by the substrate circling means are independent from each other.

37. A substrate cutting system according to claim 36, wherein the dynamic power supply of the substrate rotating means and the dynamic power supply of the substrate circling means are independent from each other.

38. A substrate cutting system according to claim 31, further comprising a substrate inversion device for inverting the top and bottom surfaces of the substrate transported by the substrate transportation device.

39. A substrate cutting system according to claim 1, comprising a positioning unit section for positioning the substrate.

40. A substrate cutting system according to claim 39, wherein the positioning unit section includes a plurality of vacuum adsorption heads for holding the substrate.

41. A substrate cutting system according to claim 32, wherein the substrate holding means is a plurality of vacuum adsorption heads for holding the substrate.

42. A substrate cutting system according to claim 40, wherein the vacuum adsorption head includes:

a vacuum adsorption pad for vacuum-adsorbing the substrate;

a suction shaft for holding the suction pad and having an exhaust hole provided thereon, the exhaust hole for exhausting air into the adsorption pad;

a casing section for regulating the moving range of the suction shaft to hold the suction shaft such that the suction shaft is slightly movable; and

an elastic supporting member for elastically holding the suction shaft such that the suction shaft is slightly movable within the casing section in its axial direction and in a direction oblique to the axial direction.

43. A substrate cutting system according to claim 42, wherein the suction shaft includes the step section in a shape of handguard provided at approximately in the middle of the casing section,

the casing section includes:

a cylindrical section having a space therewithin, the space for holding the elastic supporting member such that the elastic supporting member is deformable;

an upper casing plate for closing an upper end of the cylindrical section with a first opening remaining open; and

a lower casing plate for closing a lower end of the cylindrical section with a second opening remaining open,

the elastic supporting section includes:

an upper spring held between the upper casing plate and the step section;

a lower spring held between the lower casing plate and the step section.

44. A substrate cutting system according to claim 40, wherein the plurality of vacuum adsorption heads includes a plurality of adsorption pads for holding the

substrate by suction or causing compressed air to gush so as to float the substrate, and

the plurality of vacuum adsorption heads positions the substrate in a state in which a laminar flow is formed between each of the plurality of adsorption pads and the substrate.

45. A substrate cutting system according to any one of claims 31, 32 and 38, comprising a removal means for removing an unnecessary portion of the cut substrate.

46. A substrate cutting system according to claim 10, wherein the plurality of belts is wound around between a frame on a carry-in side of the substrate and a frame on a carry-out side of the substrate, and

the plurality of belts lowers below the scribing device guide body or emerges above the scribing device guide body from under the scribing device guide body while the first substrate supporting section is moving.

47. A substrate cutting system according to claim 19, wherein the plurality of belts is wound around between a frame on a carry-in side of the substrate and a frame on a carry-out side of the substrate, and

the plurality of belts lowers below the scribing device guide body or emerges above the scribing device guide body from under the scribing device guide body while the second substrate supporting section is moving.

48. A substrate cutting system according to claim 1, wherein the substrate is a bonded mother substrate for which a pair of mother substrates are bonded to each other.

49. A substrate manufacturing apparatus, comprising:

a substrate cutting system according to claim 1; and

a chamfering system for chamfering an edge face of a cut substrate,

wherein the substrate cutting system is connected to the chamfering system.

50. A substrate manufacturing apparatus, comprising:

a substrate cutting system according to claim 1; and

an inspection system for inspecting the function of a cut substrate,

wherein the substrate cutting system is connected to the inspection system.

51. A substrate manufacturing apparatus according to claim 49, further comprising an inspection system for inspecting the function of the cut substrate.

52. A method for cutting a plurality of unit substrates from a mother substrate, the method comprising:

a forming step of forming scribing lines on a first surface of the mother substrate and a second surface of the mother substrate by a pair of scribing line forming means,

the forming step includes the step of forming, on the mother substrate, a first scribing line for cutting a first unit substrate from the mother substrate and a second scribing line for cutting a second unit substrate from the mother substrate by moving the pressure onto the mother substrate by each of the pair of scribing line forming means such that the pressure onto the mother substrate is not interrupted.

53. A substrate cutting method according to claim 52 wherein the forming step further includes the step of forming number N scribing line for cutting number N unit substrate from the mother substrate by moving the pressure onto the mother substrate such that the pressure onto the mother substrate is not interrupted, and N is an integer which is larger than or equal to 3.

54. A substrate cutting method according to claim 52 wherein the forming step includes the steps of:

(1) forming the scribing line on the mother substrate by moving the pressure onto the mother substrate along the outside side of the first unit substrate and the outside side of the second unit substrate;

(2) forming the scribing line on the mother substrate by moving the pressure onto the mother substrate on an edge of an outer circumference of the mother substrate; and

(3) forming the scribing line on the mother substrate by moving the pressure onto the mother substrate along the inside side of the first unit substrate and the inside side of the second unit substrate.

55. A substrate cutting method according to claim 54 wherein the inside side of the second unit substrate faces the insides side of the first unit substrate,

the step (3) includes the steps of:

(3a) forming the scribing line on the mother substrate by moving the pressure onto the mother substrate along the inside side of the first unit substrate;

(3b) after performing (3a), forming the scribing line on the mother substrate by moving the pressure onto the mother substrate on an edge of an outer circumference of the (mother) substrate;

(3c) after performing (3b), forming the scribing line on the mother substrate by moving the pressure onto the mother substrate along the inside side of the second unit substrate;

(3d) after performing (3c), forming the scribing line on the mother substrate by moving the pressure onto the mother substrate on an edge of an outer circumference of the (mother ) substrate;

56. A substrate cutting method according to claim 52 wherein the forming step further includes the step of reducing the pressure onto the mother substrate.

57. A substrate cutting method according to claim 52 wherein the forming step includes the steps of:

forming the scribing line along a first direction; and

moving the pressure onto the mother substrate such that a scribing line formed along the first direction and a scribing line to be formed along a second direction are connected to each other by a curve, the second direction being different from the first direction.

58. A method for cutting a brittle material substrate, the brittle material substrate being cut by a device,

the device including:

a substrate supporting device for supporting a lower surface of the brittle material substrate and fixing at least one end of the brittle material substrate; and

a pair of scribing line forming means arranged on both sides of the brittle material substrate's surface, the pair of scribing forming section facing each other with the brittle material substrate therebetween,

the substrate supporting device has a space in the center of the substrate supporting device,

the pair of scribing line forming means is arranged in the space in the middle of the substrate supporting device,

the method comprising the step of:

moving the pair of scribing line forming means in at least one direction of an X axial direction and a Y axial direction and further moving the substrate supporting device in at least one direction of the X axial direction and the Y axial direction so as to cut the brittle material substrate.

59. A substrate cutting method according to claim 58, wherein the substrate supporting device supports the brittle material substrate so as not to rub the substrate or exert any force on the brittle material substrate.